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(54) **High velocity, hot air dryer and extractor**

Hochgeschwindigkeitslufttrockner und Absaugvorrichtung

Dispositif sécheur à air chaud à haute vitesse et dispositif d'extraction

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Description

This invention relates generally to accessories for sheet-fed, rotary offset and flexographic printing presses, and in particular to a dryer for printed materials which utilizes high velocity, hot air flow and extraction.

In the operation of a rotary offset press, an image is reproduced on a web or sheet of paper or some other printable substrate by a plate cylinder which carries the image, a blanket cylinder which has an ink transfer surface for receiving the inked image, and an impression cylinder which presses the paper against the blanket cylinder so that the inked image is transferred to the paper. In some applications, a protective and/or decorative coating is applied to the surface of the freshly printed sheets. The freshly printed sheets are then transported to a sheet delivery stacker in which the printed sheets are collected and stacked.

The relatively wet condition of the printing ink composition and its solvent and/or diluent components and a layer of moisture laden air which clings to the surface of the freshly printed web or sheet may interfere with the quality of the images as they are printed at each succeeding printing unit. For example, the quality of colored images, half-tone illustrations and the like undergo degradation in the uniformity of their appearance and color because of the presence of the wet ink, volatiles, and moisture within the printed substrate. Moreover, protective coatings will undergo dilution and surface degradation causing a dull finish if the underlying substrate is not dried sufficiently before the coating is applied.

Such defects, including uneven surface appearance of protective/decorative coatings, detract from the appearance of the underlying images or photographs, particularly in the case of multi-colored images or photographs. The defects are caused by residual volatile solvents, diluents, water and the like within the oleoresinous inks of the images, and the presence of moisture in the printed material, at the time that the next successive image is printed or the protective/decorative coating is applied. Because the defects are compounded as the printed material moves through successive printing units, it is desirable that curing and drying be initiated and volatiles and moisture laden air be extracted at each interstation position, as well as at the delivery position.

Hot air dryers and radiant heaters have been used as delivery dryers and as interstation dryers. Interstation dryers employing radiant heat lamps are best suited for slow to moderate press speeds in which the exposure time of each printed sheet to the radiant heat is long enough to initiate ink setting. For high speed press operation, for example, at 5,000 sheets or more per hour, there is not enough available space at the interstation position to install a radiant heater having sufficient number of heat lamps for adequate drying purposes.

As press speed is increased, the exposure time (the length of time that a printed sheet is exposed to the radiant heat) is reduced. Since the number of lamps is limited by the available interstation space, the output power of the radiant lamps has been increased to deliver more radiant energy at higher temperatures to the printed sheets in an effort to compensate for the reduction in exposure time. The increased operating temperatures of the high-powered radiant heat lamps cause significant heat transfer to the associated printing unit and other equipment mounted on the press frame, accelerated wear of bearings and alterations in the viscosities of the ink and coating, as well as upsetting the balance between dampening solution and ink. The heat build-up may also cause operator discomfort and injury.

To handle high speed press operations, an off-press heater has been utilized from which high velocity, heated air is conveyed through a thermally insulated supply duct to a discharge plenum which directs high velocity, heated air onto the printed stock as it moves across the interstation dryer position. Such off-press heaters have proven to be relatively inefficient because of excessive heat loss and pressure drop along the supply duct. Attempts to overcome the heat loss and pressure drop have resulted in substantially increased physical size of the heater equipment (blower fan and supply duct) along with a substantial increase in the electrical power dissipated by the off-press heater.

It has also been proposed (US 2683939) to provide an electric drying and exhaust unit for the quick drying of a moving web, having a hot air distributor comprising concentric inner and outer jackets extending across the web, a flow of air heated in the inner jacket escaping from one end into the annular space between the jackets to be directed onto the web through a row of discharge apertures in the outer jacket. However, the apparatus described in US 2683939 does not suggest how the heated air can be distributed uniformly across the width of the web, as would be required for efficient operation.

According to one aspect of the present invention, a hot air drier is provided for installation in a printing press, said dryer comprising a dryer head having a housing member defining an air distribution chamber, the housing member having an airflow inlet port for receiving high velocity air and an airflow discharge port for directing heated air onto a substrate, an air delivery tube being disposed in the air distribution chamber, the air delivery tube having an elongated airflow passage connecting the inlet port in airflow communication with the air distribution chamber, a heating element being disposed within the elongated airflow passage of the air delivery tube, the inlet area of the inlet port being greater than the outlet area of the discharge port to ensure uniform discharge of air from the dryer. By observing the stated relationship between the flow areas of the inlet and discharge ports, it can be ensured that if, for example, the discharge port takes the form of a series of outlet apertures, the hot air is discharged through the outlet apertures in a corresponding series

of jets which are uniform in pressure and velocity along the length of the dryer head, so that the printed sheet is dried uniformly as it is transferred through the exposure zone of the dryer.

By directing the hot air onto the surface of the printed sheet as a series of high-velocity hot air jets, these can scrub and break-up the moisture-laden air layer that adheres to the printed surface of the sheet The high-velocity hot air jets create turbulence to overcome the surface tension of the moisture and separate the moisture laden air from the surface of the printed material. The moisture vapour and volatiles can then become entrained in the forced air flow and be removed from the printing unit by a high volume extractor.

The scrubbing action of the high velocity hot air jets is improved by providing adjacent rows of multiple discharge apertures which are oriented to deliver a converging pattern of high velocity hot air jets into an exposure zone across the sheet travel path. The high velocity hot air jets can be produced by a pair of elongated dryer heads in which high velocity air is heated by heat transfer contact with a resistance heating element within an air delivery baffle tube. Since the release of moisture and other volatiles from the ink and printed material occurs continuously in response to the absorption of thermal energy, the moisture laden air layer is displaced continuously from the printed sheet as the printed sheet travels through the dryer exposure zone in contact with the converging hot air jets. To exhaust completely the moisture-laden air and volatiles, an extractor manifold is coupled to the dryer heads and draws the air and volatiles from the exposure zone through a longitudinal air gap between the dryer heads. In this arrangement, the setting of ink on each printed sheet is initiated and accelerated before the sheet is run through the next printing unit.

According to a further aspect of the invention, a method is provided for drying a freshly processed substrate in a printing press comprising the steps of directing high velocity air through an air delivery tube which is disposed within an air distribution chamber, heating high velocity air flowing through the air delivery tube by heat transfer contact with an elongated heating element disposed within the air delivery tube, and discharging heated air from the air distribution chamber onto the freshly processed substrate, the heated air being discharged uniformly through a discharge port onto the substrate.

Further features and advantages of the present invention will be understood by those skilled in the art upon reading the detailed description which follows with reference to the attached drawings, wherein:

Fig. 1 is a schematic side elevational view in which multiple dryers of the present invention are installed at interstation positions in a four colour offset rotary printing press;

Fig. 2 is a simplified side elevational view showing the dryer of the present invention installed in an interstation position between two printing units of Fig. 1;

Fig. 3 is a bottom plan view showing installation of the dryer assembly of Fig. 2 in the interstation position;

FIGURE 4 is a perspective view of the interstation dryer shown in FIGURE 2;

FIGURE 5 is a sectional view of the improved dryer of the present invention taken along the line 5-5 of FIGURE 4;

FIGURE 6 is a longitudinal sectional view of the dryer assembly shown in FIGURE 2;

FIGURE 7 is a sectional view of the dryer assembly shown in FIGURE 2, taken along the line 7-7 of FIGURE 6;

FIGURE 8 is a perspective view of a resistance heating element used in the dryer of FIGURE 2;

FIGURE 9 is a perspective view similar to FIGURE 8, with the resistance heating element enclosed in a support sheath;

FIGURE 10 is a view similar to FIGURE 4 which illustrates an alternative embodiment of the dryer head in which the discharge port is formed by an elongated slot; and,

FIGURE 11 is a perspective view, partially broken away, of the dryer head shown in FIGURE 10.

As used herein, the term "processed" refers to various printing processes which may be applied to either side of a sheet, including the application of inks and/or coatings. The term "substrate" refers to sheet material or web material.

Referring now to FIGURE 1, the high velocity hot air dryer 10 of the present invention will be described as used for drying freshly printed substrates, which are successively printed at multiple printing units in a sheet-fed, rotary offset printing press. In the exemplary embodiment, the dryer 10 of the present invention is installed at an interstation position between two printing units of a four color printing press 12 which is capable of handling individual printed sheets having a width of the approximately 40" (102 millimeters) and capable of printing 10,000 sheets per hour or more, such as that manufactured by Heidelberg Druckmaschinen AG of Germany under its designation Heidelberg Speedmaster 102V.

The press 12 includes a press frame 14 coupled on the right end to a sheet feeder 16 from which sheets, herein designated S, are individually and sequentially fed into the press, and at the opposite end, with a sheet stacker 18 in which the printed sheets are collected and stacked. Interposed between the sheet feeder 16 and the sheet stacker 18 are four substantially identical sheet printing units 20A, 20B, 20C and 20D which can print different color inks onto the sheets as they are moved through the press.

As illustrated in FIGURE 1, each sheet fed printing

unit is of conventional design, each unit including a plate cylinder 22, a blanket cylinder 24 and an impression cylinder 26. Freshly printed sheets S from the impression cylinder 26 are transferred to the next printing unit by transfer cylinders T1, T2, T3. A protective coating may be applied to the printed sheets by a coating unit 28 which is positioned adjacent to the last printing unit 20D.

The freshly printed and coated sheets S are transported to the sheet stacker 18 by a delivery conveyor system, generally designated 30. The delivery conveyor 30 is of conventional design and includes a pair of endless delivery gripper chains 32 carrying laterally disposed gripper bars having a gripper element for gripping the leading edge of a freshly printed sheet S as it leaves the impression cylinder 26. As the leading edge of the printed sheet S is gripped by the grippers, the delivery chains 32 pull the gripper bar and sheet S away from the impression cylinder 26 and transports the freshly printed and/or coated sheet to the sheet stacker 18.

Prior to delivery, the freshly printed sheets S pass through a delivery dryer 34 which includes a combination of infra-red thermal radiation, forced air flow and extraction.

Referring now to FIGURE 2, FIGURE 5 and FIGURE 6, the interstation dryer 10 includes as its principal components a dryer head 36, a resistance heating element 38, and an extractor head 40. As shown in FIGURE 3, the dryer head 36 is mounted on the press side frame members 14A, 14B by side frame flanges 42, 44. In this interstation position, the dryer head 36 is extended laterally across and radially spaced from the interstation transfer cylinder T2, thereby defining an exposure zone Z.

The dryer head 36 includes a tubular sidewall 36W which encloses an air distribution manifold chamber 46. The air distribution manifold housing is sealed on opposite ends by end plates 48, 50, respectively, and is sealed against the extractor head 40. The manifold housing has an inlet port for admitting high velocity, pressurized air through a supply duct 52 from an off-press compressor 53, and has a discharge port for delivering pressurized hot air into the exposure zone Z.

As shown in FIGURE 6, the air distribution manifold sidewall 36W is intersected by multiple discharge apertures 54 which collectively define the discharge port. The apertures 54 are oriented for discharglng pressurized jets of high velocity, hot air toward the interstation transfer cylinder T2, and are longitudinally spaced along the dryer head 36. According to this arrangement, pressurized air jets are directed along a straight line across the printed side of a sheet S as it moves through the dryer exposure zone Z. In an alternative embodiment, as shown in FIGURE 10 and FIGURE 11, the discharge port is formed by an elongated slot 55 which intersects the dryer head sidewall 36W and extends longitudinally along the dryer head.

Referring now to FIGURE 6 and FIGURE 7, the resistance heating element 38 is coupled to the dryer head 36 by and end block 56. The end block 56 has a body portion which is intersected by an axial bore 58, a counterbore 60 and a radial inlet bore 62 which communicates with the counterbore. The heating element 38 has an end portion 38A which projects through the axial bore 58 and counterbore 60, with the elongated body portion of the heating element 38 extending into the plenum chamber 46.

According to an important feature of the present invention, the plenum chamber 46 is partitioned by an elongated air delivery baffle tube 64 which extends substantially the entire length of the dryer head 36. The air delivery baffle tube 64 has an inlet port 66 for receiving high velocity airflow from a remote supply and has a tubular sidewall 64A extending through the plenum chamber. The tubular sidewall 64A has an inner airflow passage 68 which connects the inlet port 66 in airflow communication with the plenum chamber 46 through its open end 64E. The air delivery baffle tube 64 has an end portion 64B projecting through the axial bore 60 of the end block 56, with its inner airflow passage 66 in airflow registration with the radial bore 62.

A pneumatic connector 70 is coupled to the radial inlet bore 62 of the end block 56 for connecting the inner airflow passage 68 to an off-press source of high velocity air. The end block 56 is sealed against the end plate 50, the tubular sheath 78 and against the pneumatic connector 70. High velocity, pressurized air is constrained to flow from the air duct 52 into the airflow passage 68 where it is discharged into the air distribution plenum chamber 46 after absorbing heat from the heating element 38.

As shown in FIGURE 6, the high velocity air flows longitudinally through the annular flow passage 68 in heat transfer contact with the heating element 38. The high velocity air is heated to a high temperature, for example 350°F (176°C), before it is discharged through the airflow apertures 54.

To provide uniform air jet discharge through the apertures 54, the inlet area of the inlet port 66 should be greater than the combined outlet area provided by the multiple airflow discharge apertures 54. In the preferred embodiment, the discharge apertures 54 have a diameter of 1/16 inch (0.158 cm), and for a 40" (102 mm) press there are 88 apertures spaced apart along the dryer head 36 on 0.446 inch (1.13 cm) centers. This yields a total airflow outlet area of 0.269 square inch (1.735 square cm). Preferably, the effective inlet area of the inlet port 66 is at least about 0.54 square inch (3.484 square cm).

In the alternative dryer head embodiment shown in FIGURE 10, the air discharge slot 55 has a length of 40 inches (102 mm) along its longitudinal dimension L, and has an arc length C of 6.725 mils (17×10^{-3} cm).

With the preferred inlet/outlet ratio of about 2:1 or more, the high velocity, heated air will be supplied to, the

plenum chamber 46 more freely than it can be discharged, so that the heated air will be compressed within the manifold plenum chamber. This assures that the jets of hot air which are discharged through the outlet apertures 54 are uniform in pressure and velocity along the length of the dryer head, so that the printed sheet is dried uniformly as it is transferred through the exposure zone Z.

The air distribution baffle tube 64 is supported on the inlet end by the end plate 50, and on its discharge end by flange segments 64F which engage the internal bore of the dryer head 36 and positions the baffle tube in the center of the plenum chamber 46.

Referring now to FIGURE 6, FIGURE 7, FIGURE 8 and FIGURE 9, the heating element 38 is preferably an electrical resistance heater having elongated resistance heater sections 38C, 38D which are integrally formed and folded together about at a common end 38E. The resistance sections 38C, 38D are substantially coextensive in length with the air delivery baffle tube 64. Each section 38C, 38D is electrically connected to a power conductor 72, 74, respectively, for connecting the resistance heating element 38 to an off-press source of electrical power.

The resistance heater sections 38C, 38D are mechanically stabilized by an end connector 76, and are enclosed within a tubular, thermally conductive sheath 78. Radial expansion of the half sections 38C, 38D is limited by the sidewall of the sheath 78, thus assuring efficient heat transfer, while the sheath provides longitudinal support for the elongated resistance heater sections within the inner airflow passage 68. The heating element half-sections 38C, 38D thus form a continuous loop resistance heating circuit which is energized through the power conductors 72, 74.

The tubular sheath 78 is received within the bore 58 and is welded to the end block 56. The tubular sheath 78 thus provides an opening through the end block 56 to permit insertion and withdrawal of the heating element 38 for replacement purposes. The heating element 38 is dimensioned for a sliding fit within the sheath 78 at ambient temperature. The end cap 76 is releasably secured to the end block 56 by a hold-down metal strap (not illustrated). The distal end 78B of the sheath is sealed by an end cap 78C to prevent leakage of high velocity air out of the distribution manifold chamber 46.

Referring now to FIGURE 2, FIGURE 4, and FIGURE 5, the extractor head 40 is coupled to the back side of a pair of identical dryer heads 36A, 36B. The dryer heads 36A, 36B are separated by a longitudinal air gap 80 which opens in air flow communication with an extractor manifold chamber 82, thereby defining a manifold inlet port. The extractor manifold chamber 82 is enclosed by the end plates 48, 50 and by housing panels 40A, 40B, 40C and 40D. The extractor housing panels 40C, 40D are secured and sealed by a welded union to the dryer heads 36A, 36B.

According to another preferred feature of the present invention, the multiple air flow apertures 54 of each dryer head 36A, 36B are arranged in linear rows R1, R2, respectively, and extend transversely with respect to the direction of sheet travel as indicate by the arrows S in FIGURE 3. The rows R1, R2 are longitudinally spaced with respect to each other along the sheet travel path. Each air jet expands in a conical pattern as it emerges from the airflow aperture 54. Expanding air jets from adjacent rows intermix within the exposure zone Z, thereby producing turbulent movement of high velocity hot air which scrubs the processed side of the sheet S as it moves through the exposure zone Z. Preferably, balanced air pressure is applied uniformly across the exposure zone Z to ensure that the moist air layer is completely separated and extracted from the freshly printed sheets.

In the exemplary embodiment, the pressure of the high velocity air as it is discharged through the inlet port 66 into the heat transfer passage 68 is about 10 psi (7031 Kgs/m^2). The inlet suction pressure in the longitudinal air gap 80 of the extractor is preferably about 5 inches of water (12.7 x 10^{-3} Kgs/cm^3).

As shown in FIGURE 3 and FIGURE 5, the extractor manifold inlet port 80 is coupled in air flow communication with the exposure zone Z for extracting heat, moisture laden air and volatiles out of the dryer. The extractor manifold chamber 82 is coupled in air flow communication with an exhaust fan 84 by an air duct 86. The air duct 86 is coupled to the extractor manifold chamber 82 by a transition duct fitting 88.

The high velocity, heated air which is discharged onto the printed sheet S is also extracted along with the moisture and volatiles through the air gap 80 into the extractor chamber 82. Ambient air, as indicated by the curved arrows, is also suctioned into the exposure zone Z and through the longitudinal air gap, thus assuring that hone of the hot air, moisture or volatiles will escape into the press area. Extraction from the exposure zone Z is enhanced by directing the hot air jets along converging lines whose intersection defines an acute angle alpha (α), as shown in FIGURE 5.

The air flow capacity of the exhaust fan 84 is preferably about four times the total airflow input to the dryer heads. This will ensure that the exposure zone Z is maintained at a pressure level less than atmospheric thereby preventing the escape of hot air, moisture laden air and volatiles into the press room.

Claims

1. A hot air dryer (10) for installation in a printing press (12), said dryer comprising a dryer head (36) having a housing member (36W) defining an air distribution chamber (46), the housing member having an airflow inlet port for receiving high velocity air and an airflow discharge port (54,55) for directing heated air onto a substrate (S), an air delivery tube (64) being disposed in the air distribution chamber,

the air delivery tube having an elongated airflow passage (68) connecting the inlet port in airflow communication with the air distribution chamber, a heating element (38) being disposed within the elongated airflow passage (68) of the air delivery tube (64), characterised in that: the inlet area of the inlet port is greater than the outlet area of the discharge port (54,55) to ensure uniform discharge of air from the dryer.

2. A hot air dryer (10) as defined in claim 1, wherein

pneumatic connector means (70) are coupled to the air delivery tube (64) for connecting the elongated air flow passage (68) to a source of high velocity air.

3. A hot air dryer (10) as defined in claim 1 or claim 2, wherein

electrical conductors (72, 74) are coupled to the heating element (38) for connecting the heating element to a source of electrical power.

4. A hot air dryer (10) as defined in any one of claims 1 to 3, wherein

an end block (56) is coupled to the housing member (36) and to the air delivery tube (64) for sealing the interface between the air delivery tube and the housing member.

5. A hot air dryer (10) as defined in any one of claims 1 to 3, wherein

an end block (56) is coupled to the housing member (36), the end block having a body portion intersected by an axial bore (58), a counterbore (60) and a radial inlet bore (62) communicating with the counterbore;
the heating element (38) having an end portion (38A) projecting through the axial bore and counterbore; and,
the air delivery tube (64) having an end portion (64B) disposed in the counterbore (60) with its elongated airflow passage (68) being coupled in airflow communication with the radial inlet bore (62).

6. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the elongated heating element (38) comprises an electrical resistance heater (38C, 38D).

7. A hot air dryer (10) as defined in claim 6, wherein

the heating element (38) has first and second resistance heater sections (38C,38D), the sections being joined at a common end (38E) and disposed in side-by-side relation.

8. A hot air dryer (10) as defined in any one of the preceding claims, wherein

a tubular, thermally conductive sheath (78) is disposed within the elongated airflow passage (68); and,
the heating element (38) is disposed within the sheath.

9. A hot air dryer (10) as defined in any one of the preceding claims, wherein

an extractor head (40) is coupled to the dryer head (36), the extractor head including a housing member (40A, 40B, 40C, 40D) defining an extractor manifold chamber (82), the extractor head having an elongated inlet port (80) for extracting air from a dryer exposure zone Z into the extractor manifold chamber, and having discharge means (84, 86, 88) coupled to the extractor head for exhausting air from the extractor manifold chamber.

10. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the airflow discharge port (54) comprises multiple airflow apertures.

11. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the air discharge port (54) comprises an elongated slot (55).

12. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the dryer head (36) is adapted for installation in an interstation position between adjacent printing press units (20A, 20B, 20C, 20D, 18) of a printing press (12), with the airflow discharge port (54, 55) facing the processed side of a substrate (S) as it is transported along a substrate travel path.

13. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the dryer (10) includes a second dryer head (36B) disposed in side-by-side relation with the first dryer head (36A) in a position facing the freshly processed side of a substrate (S) as it moves through a dryer exposure zone (Z)

along a substrate travel path, the second dryer head (36B) having a housing member (36W) defining a second air distribution chamber (46), the housing member of the second dryer head including an inlet port for receiving high velocity air and a discharge port (54, 55) oriented for directing heated air toward the sheet travel path, with the dryer heads being separated from each other by a longitudinal air gap (80); and,

an extractor head (40) is coupled to the dryer heads (36A, 36B), the extractor head including a housing member (40A, 40B, 40C, 40D) defining an extractor manifold chamber (82) and coupled in air flow communication with the longitudinal air gap (80), and having discharge means (84, 86, 88) coupled in air flow communication with the housing member for exhausting air from the extractor manifold chamber (82).

14. A hot air dryer (10) as defined in claim 13, wherein

the discharge ports (54, 55) of the dryer heads are arranged in first and second rows (R1, R2), respectively, the rows being separated from each other along the substrate travel path, wherein heated air discharged from the discharge ports intermix with each other in the dryer exposure zone (Z).

15. A hot air dryer (10) as defined in claim 13 or claim 14, wherein

the discharge ports (54,55) of the first and second dryer heads are oriented for directing heated air along first and second converging lines respectively.

16. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the area ratio between the inlet and discharge ports is 2 to 1 or greater.

17. A hot air dryer (10) as defined in any one of the preceding claims, wherein

the outlet of the elongated air delivery tube (64) has an unrestricted outlet into the air distribution chamber.

18. A method for drying a freshly processed substrate (S) in a printing press (12) comprising the steps of:

directing high velocity air through an air delivery tube (64) which is disposed within an air distribution chamber (46);

heating high velocity air flowing through the air delivery tube by heat transfer contact with an elongated heating element (38) disposed within the air delivery tube; and

discharging heated air from the air distribution chamber onto the freshly processed substrate (S),

characterised in that:

said heated air is discharged uniformly through a discharge port (54,55) onto the substrate.

19. A method as defined in claim 18, wherein

the air is directed into the air delivery tube (64) through an inlet port of greater area than the discharge port through which the air is discharged into the substrate.

20. A method as defined in claim 19, wherein

the ratio of said areas is 2 to 1 or greater.

21. A method for drying a freshly processed substrate (S) as defined in any one of claims 17 to 20, further comprising the steps of:

discharging jets of heated air from the air distribution chamber (46) through first and second rows (R1,R2) of outlet apertures (54,55) forming said discharge port; and
intermixing air jets from the first and second rows in an exposure zone (Z).

22. A method for drying a freshly processed substrate (S) as defined in any one of claims 17 to 20, further comprising the steps of:

discharging jets of heated, pressurized air from the air distribution chamber (46) through first and second rows (R1,R2) of outlet apertures forming said discharge port; and
directing air jets discharged from air flow apertures of the first and second rows (R1,R2) along first and second converging lines respectively.

23. A method for drying a freshly processed substrate (S) as defined in any one of claims 17 to 22, further comprising the steps of :

installing first and second dryer heads (36A, 36B) in side-by-side relation on a printing press (12) in a position facing the processed side of a freshly processed substrate as it travels through a dryer exposure zone (Z), the dryer heads being separated from each other by a

longitudinal air gap (80);

supplying high velocity air to each dryer head (36A, 36B) through first and second air delivery tubes (64) which are disposed within an air distribution chamber (46) in each dryer head, respectively;

heating high velocity air flowing through each air delivery tube (64) by heat transfer contact with an elongated heating element (38) disposed within each air delivery tube;

discharging heated air from each dryer head through the dryer exposure zone (Z) and onto the freshly processed substrate (S); and

extracting air from the exposure zone (Z) through the longitudinal air gap (80).

24. A method for drying a freshly processed substrate (S) as defined in claim 22, further comprising the steps of ;

discharging heated air from each dryer head (36A, 36B) through an airflow discharge port (54, 55); and

supplying high velocity air to each dryer head through an inlet port (52) having an effective inlet flow area which is greater than the combined outlet flow areas of the discharge ports (54, 55).

25. A method for drying a freshly processed substrate (S) as defined in claim 23 or claim 24, further comprising the steps of;

discharging jets of heated air from the first and second dryer heads (36A, 36B) through first and second rows (R1, R2) of outlet apertures (54, 55), respectively; and

intermixing air jets from the first and second rows in the exposure zone (Z).

26. A method for drying a freshly printed substrate (S) as defined in any one of claims 23 to 25, further comprising the steps of;

discharging jets of heated air from the first and second dryer heads (36A, 36B) through first and second rows (R1, R2) of outlet apertures (54, 55), respectively; and

directing air jets discharged from air flow apertures of the first and second rows (R1, R2) along first and second converging lines respectively.

27. A method for drying a freshly processed substrate (S) as defined in any one of claims 23 to 26 further comprising the steps :

extracting air from the exposure zone (Z) at a volume flow rate through the longitudinal air gap (80) which exceeds the total volume flow rate of air discharged from the first and second dryer heads (36A, 36B).

Patentansprüche

1. Heißlufttrockner (10) zum Einbauen in eine Drukkerpresse (12), wobei der Trockner einen Trocknerkopf (36) umfaßt, der ein Gehäuseelement (36W) aufweist, das eine Luftverteilungskammer (46) definiert, wobei das Gehäuseelement eine Luftstromeinlaßöffnung zum Aufnehmen von Luft mit hoher Geschwindigkeit und eine Luftstromabgabeöffnung (54, 55) aufweist, um erwärmte Luft auf ein Substrat (S) zu lenken, wobei ein Luftversorgungsrohr (64) in der Luftverteilungskammer angeordnet ist, wobei das Luftversorgungsrohr einen länglichen Luftstromdurchgang (68) aufweist, der die Einlaßöffnung in Luftstromkommunikation mit der Luftverteilungskammer verbindet, wobei ein Heizelement (38) innerhalb des länglichen Luftstromdurchgangs (68) des Luftversorgungsrohres (64) angeordnet ist, dadurch gekennzeichnet, daß

die Einlaßfläche der Einlaßöffnung größer ist als die Auslaßfläche der Abgabeöffnung (54, 55), so daß gleichmäßiges Abgeben von Luft aus dem Trockner gewährleistet ist.

2. Heißlufttrockner (10) nach Anspruch 1, worin

pneumatische Verbindermittel (70) an das Luftversorgungsrohr (64) gekoppelt sind, um den länglichen Luftstromdurchgang (68) mit einer Quelle für Luft mit hoher Geschwindigkeit zu verbinden.

3. Heißlufttrockner (10) nach Anspruch 1 oder 2, worin

elektrische Leiter (72, 74) an das Heizelement (38) gekoppelt sind, um das Heizelement mit einer elektrischen Stromquelle zu verbinden.

4. Heißlufttrockner (10) nach einem der Ansprüche 1 bis 3, worin

ein Endblock (56) an das Gehäuseelement (36) und an das Luftversorgungsrohr (64) gekoppelt ist, um die Grenzfläche zwischen dem Luftversorgungsrohr und dem Gehäuseelement abzudichten.

5. Heißlufttrockner (10) nach einem der Ansprüche 1 bis 3, worin

ein Endblock (56) an das Gehäuseelement

(36) gekoppelt ist, wobei der Endblock einen Körperabschnitt aufweist, der von einer axialen Bohrung (58), einer Senkbohrung (60) und einer mit der Senkbohrung kommunizierenden radialen Einlaßbohrung (62) durchschnitten wird;

wobei das Heizelement (38) einen Endabschnitt (38A) aufweist, der durch die axiale Bohrung und die Senkbohrung ragt; und

das Luftversorgungsrohr (64) einen Endabschnitt (64B) aufweist, der so in der Senkbohrung (60) angeordnet ist, daß sein länglicher Luftstromdurchgang (68) in Luftstromkommunikation mit der radialen Einlaßbohrung (62) gekoppelt ist.

6. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin das längliche Heizelement (38) eine elektrische Widerstandsheizung (38C, 38D) umfaßt.

7. Heißlufttrockner nach Anspruch 6, worin das Heizelement (38) einen ersten und einen zweiten Widerstandsheizabschnitt (38C, 38D) aufweist, wobei die Abschnitte an einem gemeinsamen Ende (38E) aneinandergefügt und Seite an Seite zueinander angeordnet sind.

8. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin eine rohrförmige wärmeleitende Hülle (78) innerhalb des länglichen Luftstromdurchgangs (68) angeordnet ist; und das Heizelement (38) innerhalb dieser Hülle angeordnet ist.

9. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin ein Absaugkopf (40) an den Trocknerkopf (36) gekoppelt ist, wobei der Absaugkopf ein Gehäuseelement (40A, 40B, 40C, 40D) umfaßt, das eine Absaugverteilerkammer (82) definiert, wobei der Absaugkopf eine längliche Einlaßöffnung (80) zum Absaugen von Luft aus einer Trocknereinwirkzone Z in die Absaugverteilerkammer aufweist und Abgabemittei (84, 86, 88) aufweist, die an den Absaugkopf gekoppelt sind, um Luft aus der Absaugverteilerkammer abzugeben.

10. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin die Luftstromabgabeöffnung (54) mehrere Luftstromöffnungen aufweist.

11. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin die Luftabgabeöffnung (54) einen länglichen Schlitz (55) umfaßt.

12. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin der Trocknerkopf (36) zum Einbauen in einer Zwischenstationsposition zwischen benachbarten Druckerpresseneinheiten (20A, 20B, 20C, 20D, 18) einer Druckerpresse (12) ausgebildet ist, wobei die Luftstromabgabeöffnung (54, 55) der bearbeiteten Seite eines Substrats (S) zugewandt ist, während es einen Substrattransportweg entlang transportiert wird.

13. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin der Trockner (10) einen zweiten Trocknerkopf (36B) umfaßt, der Seite an Seite mit dem ersten Trocknerkopf (36A) in einer Position angeordnet ist, die der frisch bearbeiteten Seite eines Substrats (S) zugewandt ist, während er sich durch eine Trocknereinwirkzone (Z) einen Substrattransportweg entlang bewegt, wobei der zweite Trocknerkopf (36B) ein Gehäuseelement (36W) aufweist, das eine zweite Luftverteilungskammer (46) definiert, wobei das Gehäuseelement des zweiten Trocknerkopfs eine Einlaßöffnung zum Aufnehmen von Luft mit hoher Geschwindigkeit und eine Abgabeöffnung (54, 55) umfaßt, die so ausgerichtet ist, daß sie erwärmte Luft zum Substrattransportweg lenkt, wobei die Trocknerköpfe durch einen Luftlängsspalt (80) voneinander getrennt sind; und
ein Absaugkopf (40) an die Trocknerköpfe (36A, 36B) gekoppelt ist, wobei der Absaugkopf ein Gehäuseelement (40A, 40B, 40C, 40D) umfaßt, das eine Absaugverteilerkammer (82) definiert und in Luftstromkommunikation mit dem Luftlängsspalt (80) gekoppelt ist und Abgabemittel (84, 86, 88) aufweist, die in Luftstromkommunikation mit dem Gehäuseelement gekoppelt sind, um Luft aus der Absaugverteilerkammer (82) abzugeben.

14. Heißlufttrockner (10) nach Anspruch 13, worin die Abgabeöffnungen (54, 55) der Trocknerköpfe in einer ersten bzw. einer zweiten Reihe (R1, R2) angeordnet sind, wobei die Reihen den Substrattransportweg entlang voneinander getrennt sind, worin sich erwärmte Luft, die aus den Abgabeöffnungen abgegeben wird, in der Trocknereinwirkzone (Z) miteinander vermischt.

15. Heißlufttrockner (10) nach Anspruch 13 oder 14, worin die Abgabeöffnungen (54, 55) des ersten und des zweiten Trocknerkopfs so ausgerichtet sind, daß sie erwärmte Luft eine erste bzw. eine zweite konvergierende Linie entlang lenken.

16. Heißlufttrockner (10) nach einem der vorangegangenen Ansprüche, worin das Flächenverhältnis zwischen der Einlaß- und der Abgabeöffnung 2:1 oder größer ist.

17. Heißlufttrockner (10) nach einem der vorangegan-

genen Ansprüche, worin der Auslaß des länglichen Luftversorgungsrohres (64) einen uneingeschränkten Auslaß in die Luftverteilungskammer aufweist.

18. Verfahren zum Trocknen eines frisch bearbeiteten Substrats (S) in einer Druckerpresse (12), folgende Schritte umfassend:

das Lenken von Luft mit hoher Geschwindigkeit durch ein Luftversorgungsrohr (64), das innerhalb einer Luftverteilungskammer (46) angeordnet ist;

das Aufheizen von Luft, die mit hoher Geschwindigkeit durch das Luftversorgungsrohr strömt, durch Wärmeübertragungskontakt mit einem länglichen Heizelement (38), das innerhalb des Luftversorgungsrohres angeordnet ist; und

das Abgeben von erwärmter Luft aus der Luftverteilungskammer auf das frisch bearbeitete Substrat (S),
dadurch gekennzeichnet, daß
die erwärmte Luft gleichmäßig durch eine Abgabeöffnung (54, 55) auf das Substrat abgegeben wird.

19. Verfahren nach Anspruch 18, worin die Luft durch eine Einlaßöffnung in das Luftversorgungsrohr (64) gelenkt wird, die eine größere Fläche als die Abgabeöffnung aufweist, durch die Luft auf das Substrat abgegeben wird.

20. Verfahren nach Anspruch 19, worin das Verhältnis der Flächen 2:1 oder mehr beträgt.

21. Verfahren zum Trocknen von frisch bearbeitetem Substrat (S) nach einem der Ansprüche 17 bis 20, das weiters folgende Schritte umfaßt:

das Abgeben von Heißluftstrahlen aus der Luftverteilungskammer (46) durch eine erste und eine zweite Reihe (R1, R2) von Auslaßöffnungen (54, 55), die die Abgabeöffnung bilden; und

das Vermischen von Luftstrahlen aus der ersten und der zweiten Reihe in einer Einwirkzone (Z).

22. Verfahren zum Trocknen eines frisch bearbeiteten Substrats (S) nach einem der Ansprüche 17 bis 20, das weiters folgende Schritte umfaßt:

das Abgeben von Strahlen von erwärmter Druckluft aus der Luftverteilungskammer (46) durch eine erste und eine zweite Reihe (R1, R2) von Auslaßöffnungen, die die Abgabeöffnung bilden; und

das Lenken von Luftstrahlen, die aus den Luftströmungsöffnungen der ersten und der zweiten Reihe (R1, R2) abgegeben wurden, eine erste bzw. eine zweite konvergierende Linie entlang.

23. Verfahren zum Trocknen eines frisch bearbeiteten Substrats (S) nach einem der Ansprüche 17 bis 22, weiters folgende Schritte umfassend:

das Einbauen eines ersten und eines zweiten Trocknerkopfs (36A, 36B) Seite an Seite auf einer Druckerpresse (12) in einer Position, die der bearbeiteten Seite eines frisch bearbeiteten Substrats zugewandt ist, während es durch eine Trocknereinwirkzone (Z) transportiert wird, wobei die Trocknerköpfe durch einen Luftlängsspalt (80) voneinander getrennt sind;

das Zuführen von Luft mit hoher Geschwindigkeit zu jedem Trocknerkopf (36A, 36B) durch ein erstes und ein zweites Luftversorgungsrohr (64), die in jedem Trocknerkopf jeweils innerhalb einer Luftverteilungskammer (46) angeordnet sind;

das Aufheizen von Luft, die mit hoher Geschwindigkeit durch jedes Luftversorgungsrohr (64) strömt, durch Wärmeübertragungskontakt mit einem länglichen Heizelement (38), das innerhalb eines jeden Luftversorgungsrohres angeordnet ist;

das Abgeben erwärmter Luft von jedem Trocknerkopf durch die Trocknereinwirkzone (Z) und auf das frisch bearbeitete Substrat (S); und

das Absaugen von Luft aus der Einwirkzone (Z) durch den Luftlängsspalt (80).

24. Verfahren zum Trocknen eines frisch bearbeiteten Substrats (S) nach Anspruch 22, das weiters folgende Schritte umfaßt:

das Abgeben von erwärmter Luft aus jedem Trocknerkopf (36A, 36B) durch eine Luftstromabgabeöffnung (54, 55); und

das Zuführen von Luft mit hoher Geschwindigkeit zu jedem Trocknerkopf durch eine Einlaßöffnung (52) mit einer wirksamen Einlaßstromfläche, die größer ist als die kombinierten Auslaßstromflächen der Abgabeöffnungen (54, 55).

25. Verfahren zum Trocknen eines frisch bearbeiteten Substrats (S) nach Anspruch 23 oder 24, weiters folgende Schritte umfassend:

das Abgeben von Strahlen erwärmter Luft aus dem ersten und dem zweiten Trocknerkopf (36A, 36B) durch eine erste bzw. eine zweite Reihe (R1, R2) von Auslaßöffnungen (54, 55); und

das Vermischen von Luftstrahlen aus der ersten und der zweiten Reihe in der Einwirkzone (Z).

26. Verfahren zum Trocknen eines frisch bedruckten Substrats (S) nach einem der Ansprüche 23 bis 25, das weiters folgende Schritte umfaßt:

das Abgeben von Strahlen erwärmter Luft aus dem ersten und dem zweiten Trocknerkopf (36A, 36B) durch eine erste bzw. eine zweite Reihe (R1, R2) von Auslaßöffnungen (54, 55); und
das Lenken von Luftstrahlen, die aus den Luftstromöffnungen der ersten und der zweiten Reihe (R1, R2) abgegeben wurden, eine erste bzw. eine zweite konvergierende Linie entlang.

27. Verfahren zum Trocknen eines frisch bearbeiteten Substrats (S) nach einem der Ansprüche 23 bis 26, weiters folgende Schritte umfassend:

das Absaugen von Luft aus der Einwirkzone (Z) durch den Luftlängsspalt (80) mit einer Volumsströmungsrate, die die Gesamtvolumsströmungsrate von Luft übersteigt, die aus dem ersten und dem zweiten Trocknerkopf (36A, 36B) abgegeben wird.

Revendications

1. Séchoir à air chaud (10) destiné à être installé sur une presse d'impression (12), ledit séchoir comportant une tête de séchoir (36) présentant un élément en caisson (36W) définissant une chambre (46) de répartition d'air, l'élément en caisson présentant un orifice d'entrée de l'écoulement d'air servant à recevoir de l'air à haute vitesse, et un orifice de décharge de l'écoulement d'air (54, 55) servant à envoyer de l'air chauffé sur un support (S), un tube de fourniture d'air (64) étant disposé dans la chambre de répartition d'air, le tube de fourniture d'air présentant un passage allongé d'écoulement d'air (68) reliant l'orifice d'entrée à la chambre de répartition d'air par communication d'écoulement, un élément chauffant (38) étant disposé à l'intérieur du passage allongé d'écoulement d'air (68) du tube de fourniture d'air (64), caractérisé en ce que la superficie d'entrée de l'orifice d'entrée est supérieure à la superficie de sortie de l'orifice de décharge (54, 55), pour assurer une décharge uniforme de l'air par le séchoir.

2. Séchoir à air chaud (10) selon la revendication 1, dans lequel des moyens (70) de connexion pneumatique sont couplés au tube de fourniture d'air (64) pour relier le passage allongé d'écoulement d'air (68) à une source d'air à hauteur vitesse.

3. Séchoir à air chaud (10) selon la revendication 1 ou la revendication 2, dans lequel des conducteurs électriques (72, 74) sont couplés à l'élément chauffant (38) pour relier l'élément chauffant à une source d'énergie électrique.

4. Séchoir à air chaud (10) selon l'une quelconque des revendications 1 à 3, dans lequel un bloc d'extrémité (56) est couplé à l'élément en caisson (36) et au tube de fourniture d'air (64) pour fermer l'interface entre le tube de fourniture d'air et l'élément en caisson.

5. Séchoir à air chaud (10) selon l'une quelconque des revendications 1 à 3, dans lequel un bloc d'extrémité (56) est couplé à l'élément en caisson (36), une partie du corps du bloc d'extrémité étant traversée par un alésage axial (58), un contre-alésage (60) et un alésage radial d'entrée (62) en communication avec le contre-alésage;

l'élément chauffant (38) présentant une partie d'extrémité (38A) en saillie par rapport à l'alésage axial et au contre-alésage; et
le tube de fourniture d'air (64) présentant une partie d'extrémité (64B) disposée dans le contre-alésage (60), son passage allongé d'écoulement d'air (68) étant couplé en communication aéraulique avec l'alésage radial d'entrée (62).

6. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel l'élément chauffant allongé (38) comporte un réchauffeur à résistance électrique (38C, 38D).

7. Séchoir à air chaud (10) selon la revendication 6, dans lequel l'élément chauffant (38) présente une première et une deuxième partie de réchauffeur à résistance (38C, 38D), les parties étant reliées à une extrémité commune (38E) et disposées côte à côte.

8. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel un fourreau tubulaire (78) thermiquement conducteur est disposé à l'intérieur du passage allongé d'écou-

lement d'air (68); et

l'élément chauffant (38) est disposé à l'intérieur du fourreau.

9. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel

une tête d'extraction (40) est couplée à la tête (36) du séchoir, la tête d'extraction comportant un élément en caisson (40A, 40B, 40C, 40D) définissant une chambre (82) de collecteur d'extraction, la tête d'extraction présentant un orifice d'entrée allongé (80) pour extraire l'air provenant d'une zone (Z) d'exposition au séchoir et l'introduire dans la chambre de collecteur d'extraction, et présentant des moyens de décharge (84, 86, 88) couplés à la tête d'extraction pour permettre à l'air de s'échapper de la chambre du collecteur d'extraction.

10. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel l'orifice (54) de décharge de l'écoulement d'air comporte plusieurs ouvertures d'écoulement d'air.

11. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel l'orifice (54) de décharge d'air comporte une fente allongée (55).

12. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel la tête (36) du séchoir est adaptée pour être installée en position intermédiaire entre des unités contiguës de presse d'impression (20A, 20B, 20C, 20D, 18) d'une presse d'impression (12), l'orifice (54, 55) de décharge de l'écoulement d'air étant tourné vers le côté traité d'un support (S) lorsque ce support est transporté sur un parcours de déplacement du support.

13. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel le séchoir (10) comporte une deuxième tête de séchoir (36B) disposée côté à côte par rapport à la première tête de séchoir (36A), dans une position tournée vers le côté qui vient d'être traité d'un support (S) lorsque ce support traverse une zone (Z) d'exposition au séchoir dans un parcours de déplacement du support, la deuxième tête de séchoir (36B) présentant un élément en caisson (36W) définissant une deuxième chambre (46) de répartition d'air, l'élément en caisson de la deuxième tête de séchoir comportant un orifice d'entrée destiné à recevoir de l'air à haute vitesse et un orifice de décharge (54, 55) orienté de manière à diriger l'air chauffé vers le parcours de déplacement de la feuille, les têtes de séchoir étant séparées l'une de l'autre par un interstice d'air longitudinal (80); et

une tête d'extraction (40) est couplée aux têtes de séchoir (36A, 36B), la tête d'extraction comportant un élément en caisson (40A, 40B, 40C, 40D) définissant une chambre (82) de collecteur d'extraction et couplée à l'interstice d'air longitudinal (80) par communication d'écoulement d'air, et présentant des moyens de décharge (84, 86, 88) couplés à l'élément en caisson par communication d'écoulement d'air pour extraire l'air de la chambre (82) de collecteur d'extraction.

14. Séchoir à air chaud (10) selon la revendication 13, dans lequel les orifices de décharge (54, 55) des têtes de séchoir sont agencés en une première et une deuxième rangée (R1, R2) respectives, les rangées étant séparées l'une de l'autre sur le parcours de déplacement du support, l'air chauffé déchargé des orifices de décharge se mélangeant l'un avec l'autre dans la zone (Z) d'exposition au séchoir.

15. Séchoir à air chaud (10) selon la revendication 13 ou la revendication 14, dans lequel les orifices de décharge (54, 55) de la première et de la deuxième tête de séchoir sont orientés de manière à diriger l'air chauffé suivant une première et une deuxième ligne convergentes respectives.

16. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel le rapport de superficie de l'orifice d'entrée et de l'orifice de décharge est de 2 à 1 ou plus.

17. Séchoir à air chaud (10) selon l'une quelconque des revendications précédentes, dans lequel la sortie du tube allongé de fourniture d'air (64) présente une sortie sans obstacle débouchant dans la chambre de répartition d'air.

18. Procédé de séchage d'un support (S) qui vient d'être traité dans une presse d'impression (12), comportant les étapes consistant à:

envoyer de l'air à haute vitesse dans un tube de fourniture d'air (64) qui est disposé à l'intérieur d'une chambre de répartition d'air (46);
chauffer de l'air s'écoulant à haute vitesse dans le tube de fourniture d'air par contact de transfert thermique avec un élément chauffant allongé (38) disposé à l'intérieur du tube de fourniture d'air; et
décharger l'air chauffé depuis la chambre de répartition d'air jusque sur le support (S) qui vient d'être traité,

caractérisé en ce que

ledit air chauffé est déchargé uniformément sur

le support par un orifice de décharge (54, 55).

19. Procédé selon la revendication 18, dans lequel l'air est envoyé dans le tube de fourniture d'air (64) par un orifice d'entrée de superficie supérieure à celle de l'orifice de décharge par lequel l'air est déchargé sur le support.

20. Procédé selon la revendication 19, dans lequel le rapport entre lesdites superficies est de 2 à 1 ou supérieur.

21. Procédé selon l'une quelconque des revendications 17 à 20 pour le séchage d'un support (S) qui vient d'être traité, comportant en outre les étapes consistant à:

décharger des jets d'air chauffé provenant de la chambre de répartition d'air (46) par la première et la deuxième rangée (R1, R2) d'ouvertures de sortie (54, 55) formant ledit orifice de décharge; et
mélanger les jets d'air provenant de la première et de la deuxième rangée dans une zone d'exposition (Z).

22. Procédé traité selon l'une quelconque des revendications 17 à 20 pour le séchage d'un support (S) qui vient d'être, comportant en outre les étapes consistant à:

décharger des jets d'air chauffé sous pression provenant de la chambre de répartition d'air (46) par une première et une deuxième rangée (R1, R2) d'ouvertures de sortie formant ledit orifice de sortie; et
diriger les jets d'air déchargés par lesdites ouvertures d'écoulement d'air de la première et de la deuxième rangée (R1, R2) le long d'une première et d'une deuxième lignes convergentes respectives.

23. Procédé selon l'une quelconque des revendications 17 à 22 pour le séchage d'un support (S) qui vient d'être traité, comportant en outre les étapes consistant à:

installer une première et une deuxième tête de séchoir (36A, 36B) en position côte à côte sur une presse d'impression (12), en une position tournée vers le côté traité d'un support qui vient d'être traité, pendant qu'il traverse une zone (Z) d'exposition au séchoir, les têtes de séchoir étant séparées l'une de l'autre par un interstice d'air longitudinal (80);
fournir de l'air à haute vitesse à chaque tête de séchoir (36A, 36B) par un premier et un deuxième tube de fourniture d'air (64), qui sont disposés à l'intérieur d'une chambre de répartition d'air (46) respective de chaque tête de séchoir;
chauffer l'air s'écoulant à haute vitesse dans chaque tube de fourniture d'air (64) par contact de transfert thermique avec un élément chauffant allongé (38) disposé à l'intérieur de chaque tube de fourniture d'air;
décharger l'air chauffé provenant de chaque tête de séchoir à travers la zone (Z) d'exposition au séchoir et sur le support (S) qui vient d'être traité; et
extraire l'air de la zone d'exposition (Z) par l'intermédiaire de l'interstice d'air longitudinal (80).

24. Procédé selon la revendication 22 pour le séchage d'un support (S) qui vient d'être traité, comportant en outre les étapes consistant à:

décharger l'air chauffé provenant de chaque tête de séchoir (36A, 36B) par un orifice de décharge d'écoulement d'air (54, 55); et
fournir de l'air à haute vitesse à chaque tête de séchoir par un orifice d'entrée (52) dont la superficie d'écoulement efficace d'entrée est supérieure aux superficies combinées d'écoulement de sortie des orifices de décharge (54, 55).

25. Procédé selon les revendications 23 ou 24 pour le séchage d'un support (S) qui vient d'être traité, comportant en outre les étapes consistant à:

décharger des jets d'air chauffé provenant de la première et de la deuxième tête de séchoir (36A, 36B) par une première et une deuxième rangée (R1, R2) d'ouvertures de sortie (54, 55) respectives; et
mélanger les jets d'air provenant de la première et de la deuxième rangée dans la zone d'exposition (Z).

26. Procédé selon l'une quelconque des revendications 23 à 25 pour le séchage d'un support (S) qui vient d'être imprimé, comportant en outre les étapes consistant à:

décharger les jets d'air chauffé provenant de la première et de la deuxième tête de séchage (36A, 36B) par une première et une deuxième rangée (R1, R2) respectives d'ouvertures de sortie (54, 55); et
diriger les jets d'air déchargés des ouvertures d'écoulement d'air de la première et de la deuxième rangée (R1, R2) respectivement sur une première et une deuxième ligne convergentes.

27. Procédé selon l'une quelconque des revendications 23 à 26 pour le séchage d'un support (S) qui vient d'être traité, comportant en outre l'étape consistant à:

extraire l'air de la zone d'exposition (Z) par l'interstice d'air longitudinal (80) à un débit volumique qui dépasse le débit volumique total de l'air déchargé par la première et la deuxième tête de séchoir (36A, 36B).

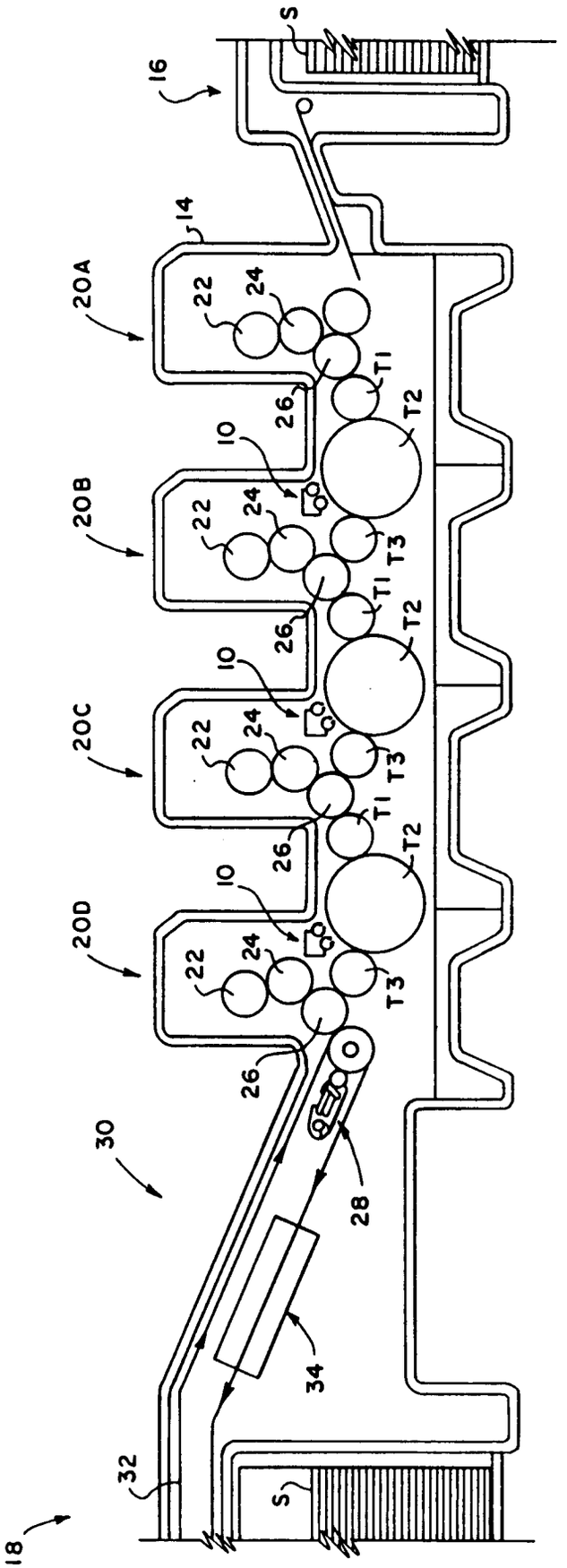

FIG. 1

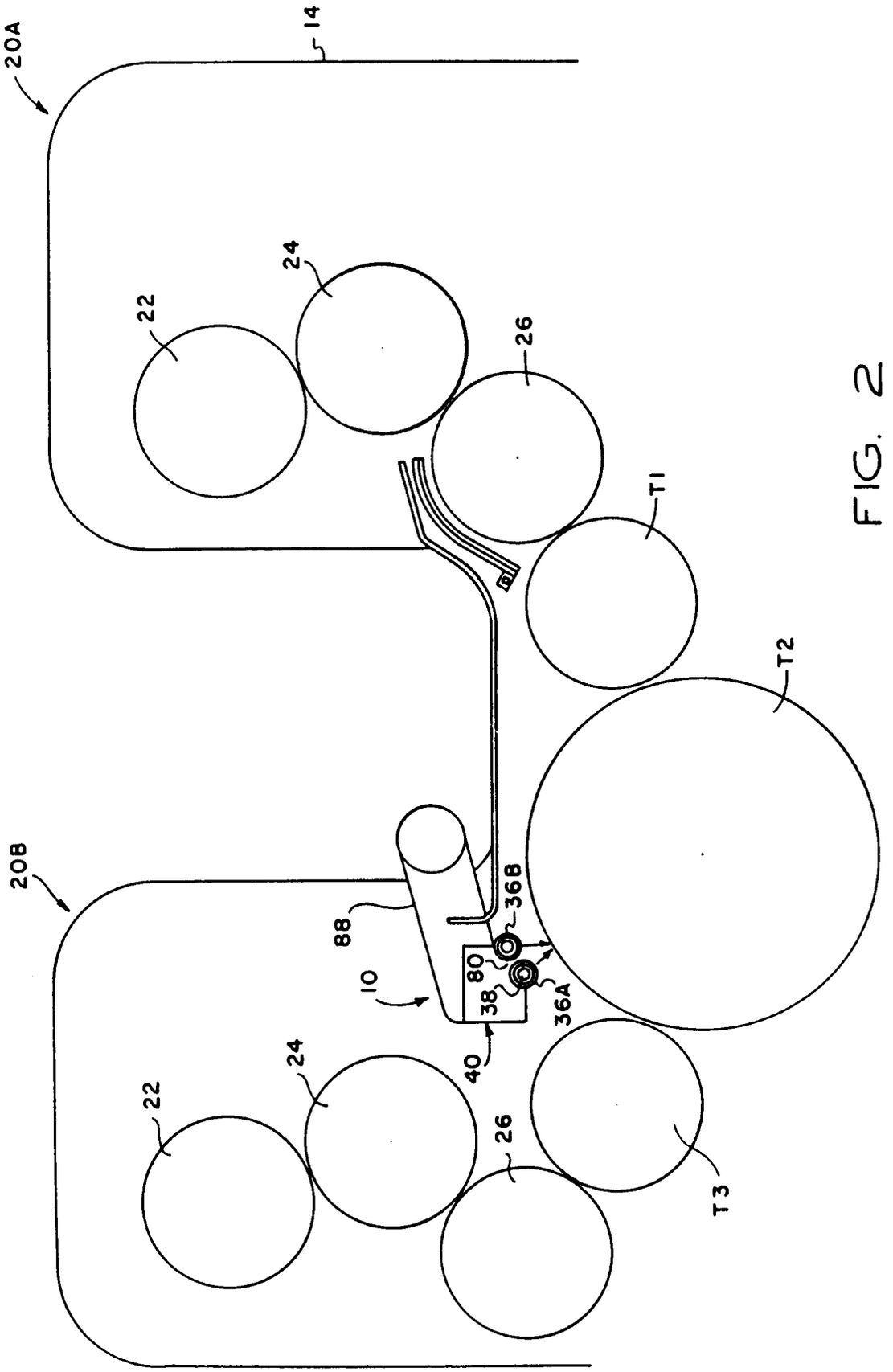

FIG. 2

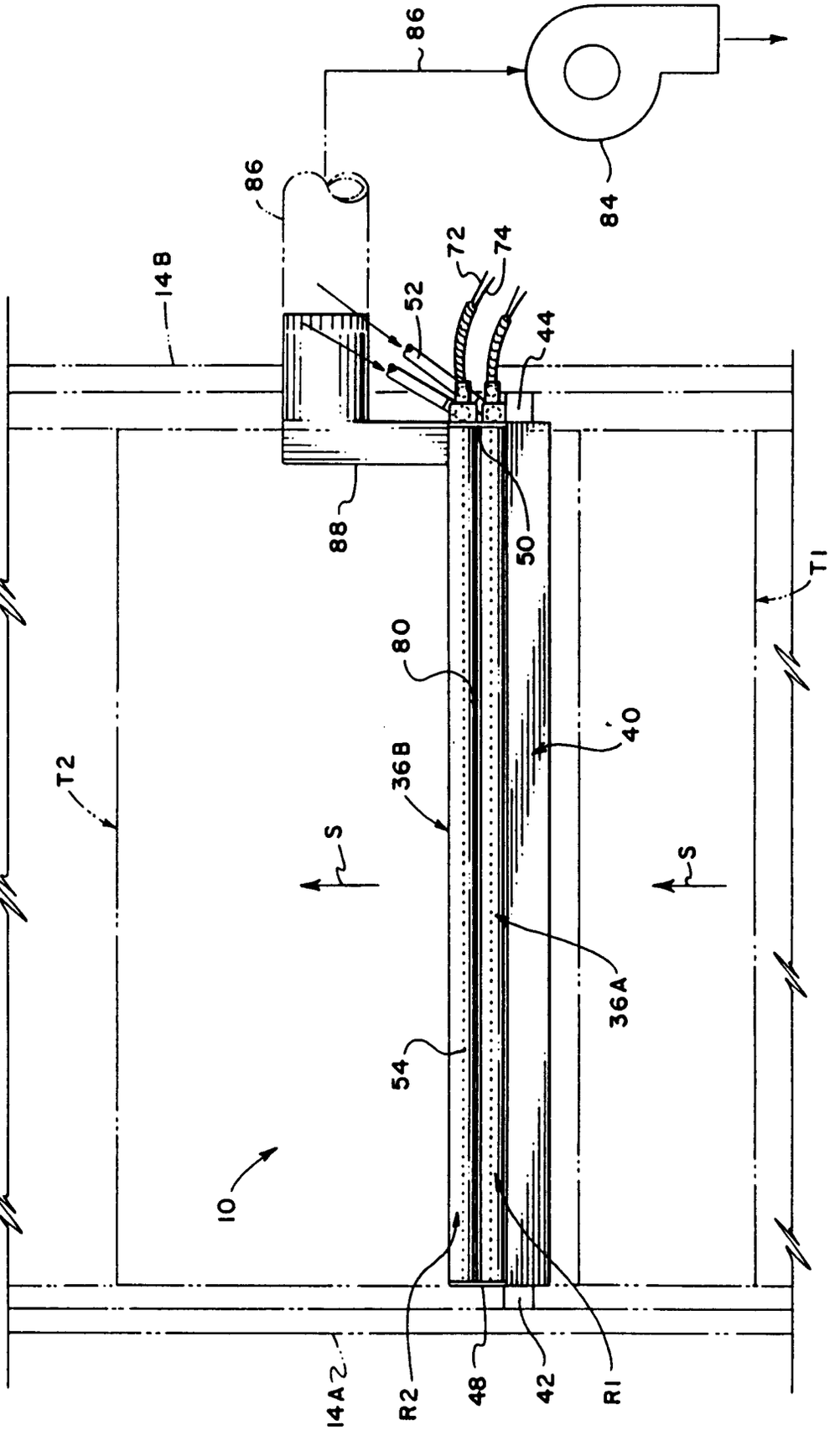
86
86
84
72
74
52
44
148
88
50
T1
80
40
36B
T2
S
S
36A
54
10
14A
R2
48
42
R1

FIG. 3

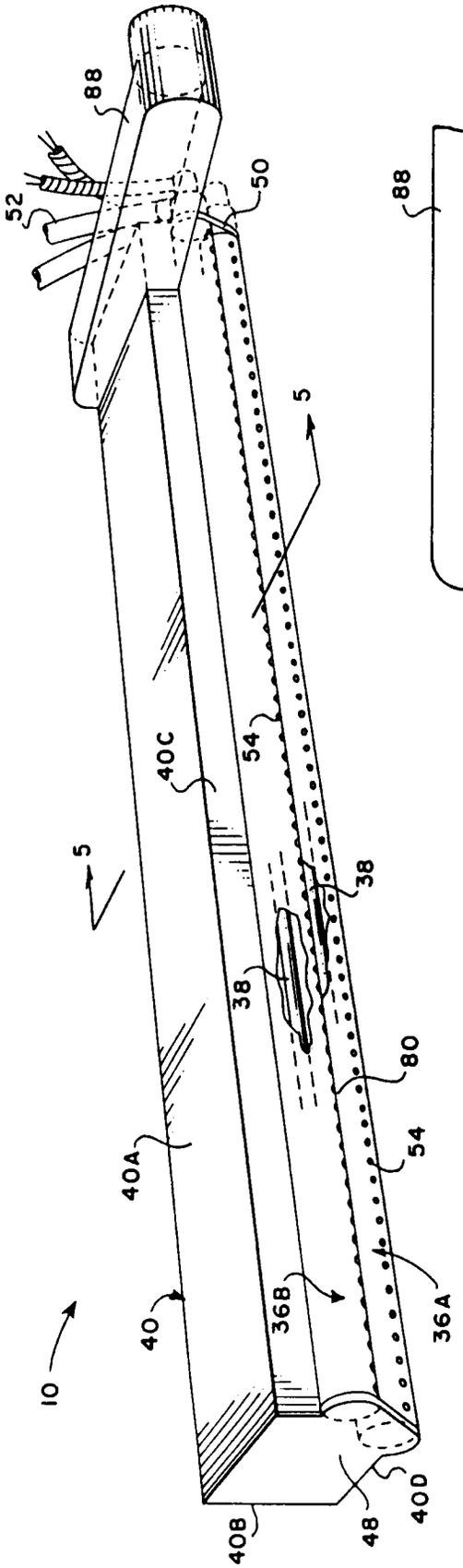
88
52
50
5
5
40C
54
38
38
80
54
40A
40
368
36A
10
40B
48
40D

FIG. 4

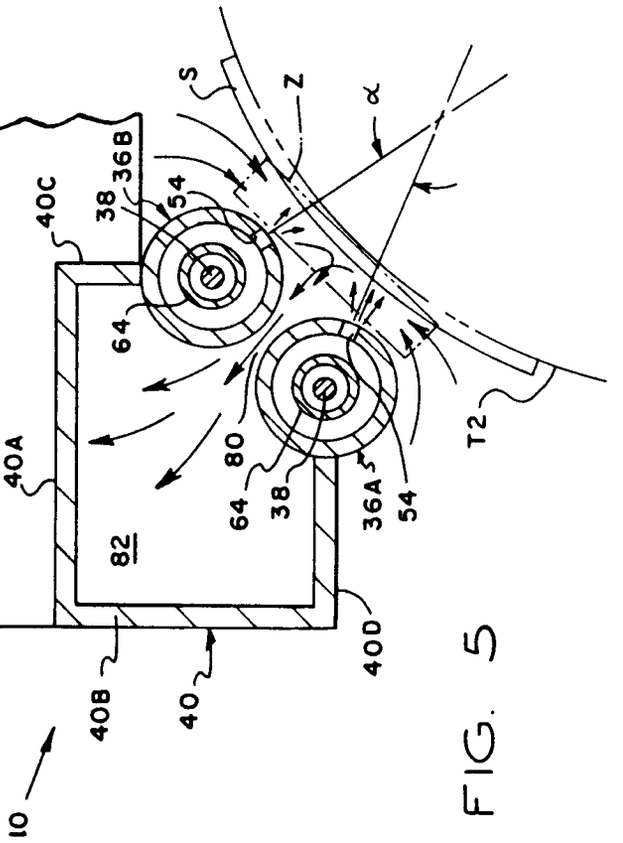
S
Z
α
88
40C
38
368
54
64
40A
82
80
64
38
36A
54
T2
40D
40B
40
10

FIG. 5

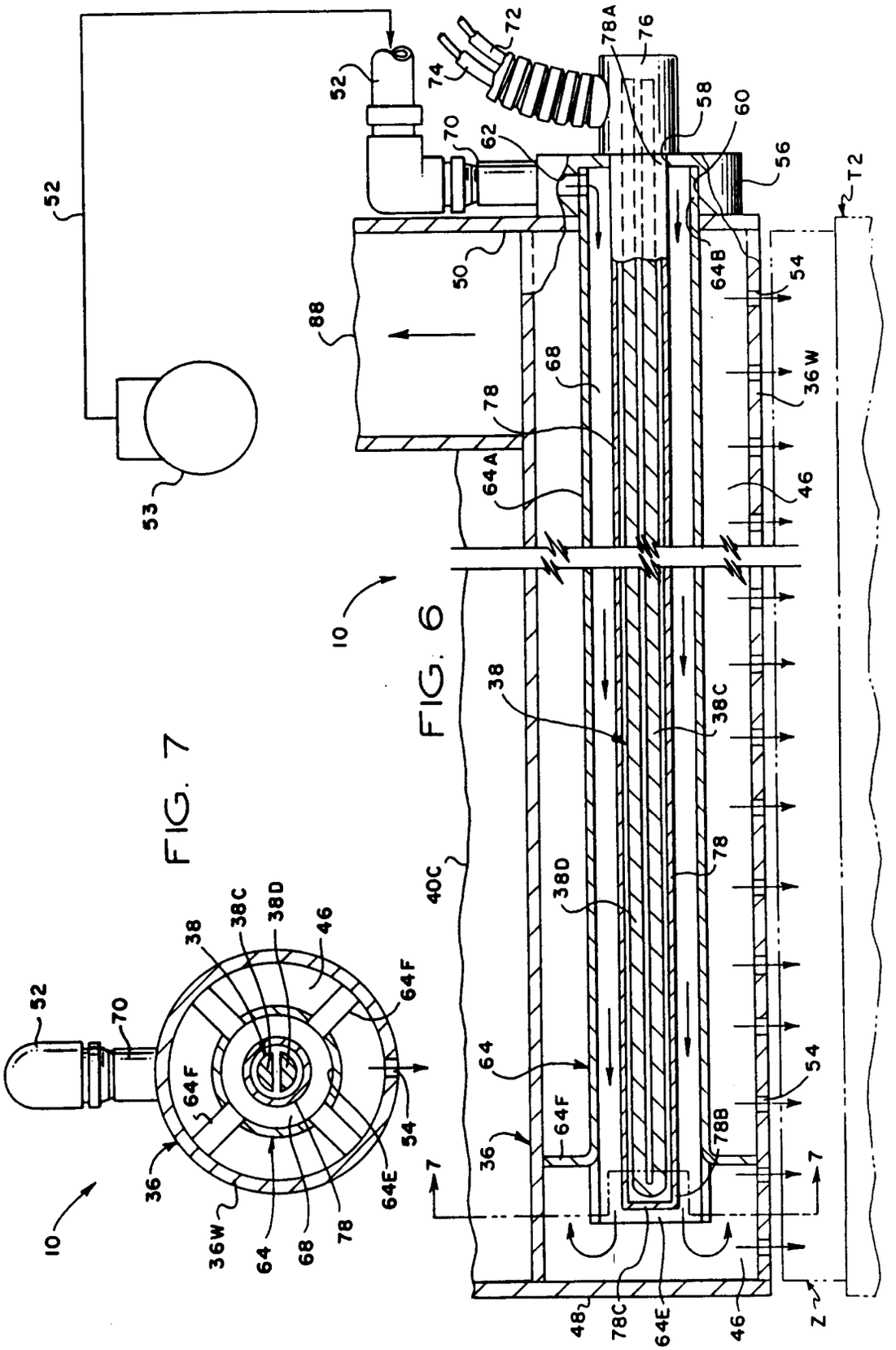
52
53
72
74
78A
76
58
60
56
62
70
50
88
64B
54
68
78
36W
64A
46
10
38
38C
40C
38D
64
64F
36
7
48
78C
64E
Z
T2

FIG. 6

52
70
38
38C
38D
46
64F
54
36
64E
10
36W
64
68
78

FIG. 7

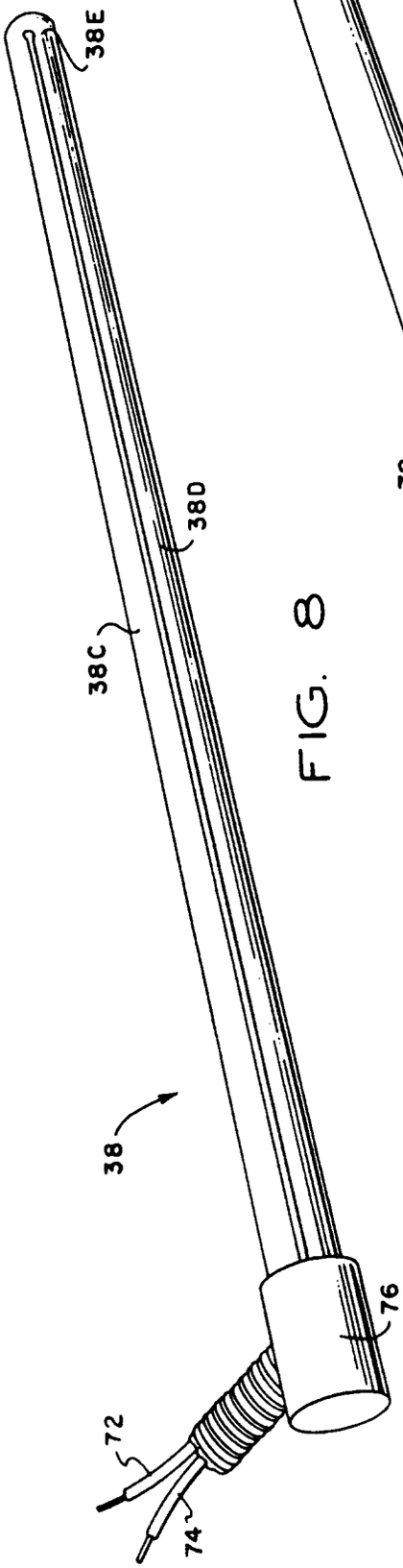

FIG. 8

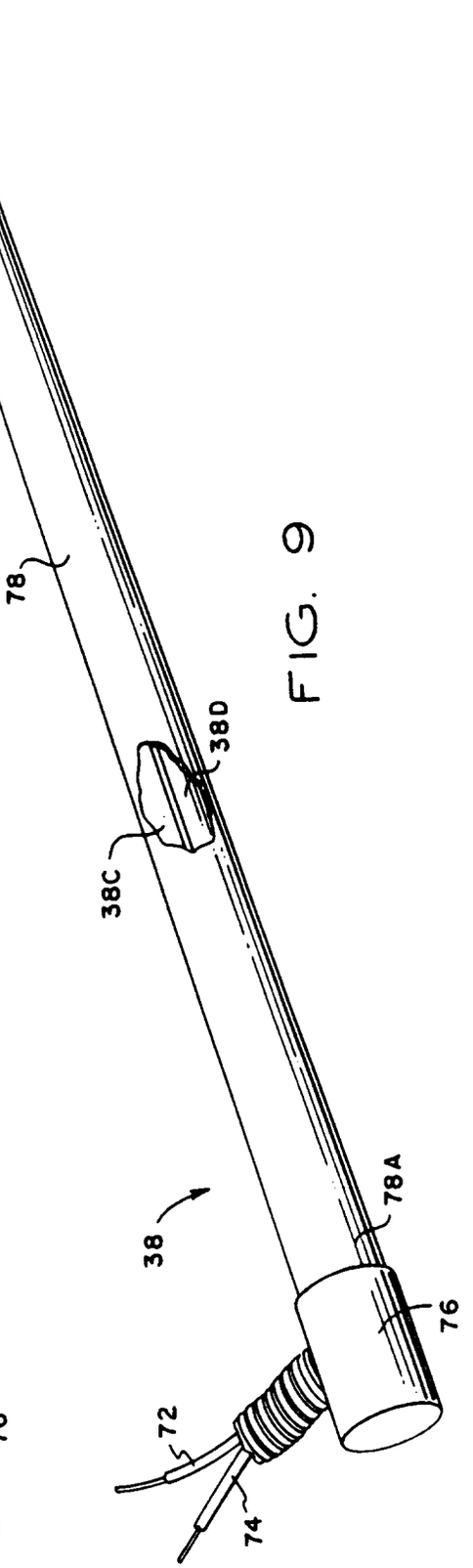

FIG. 9

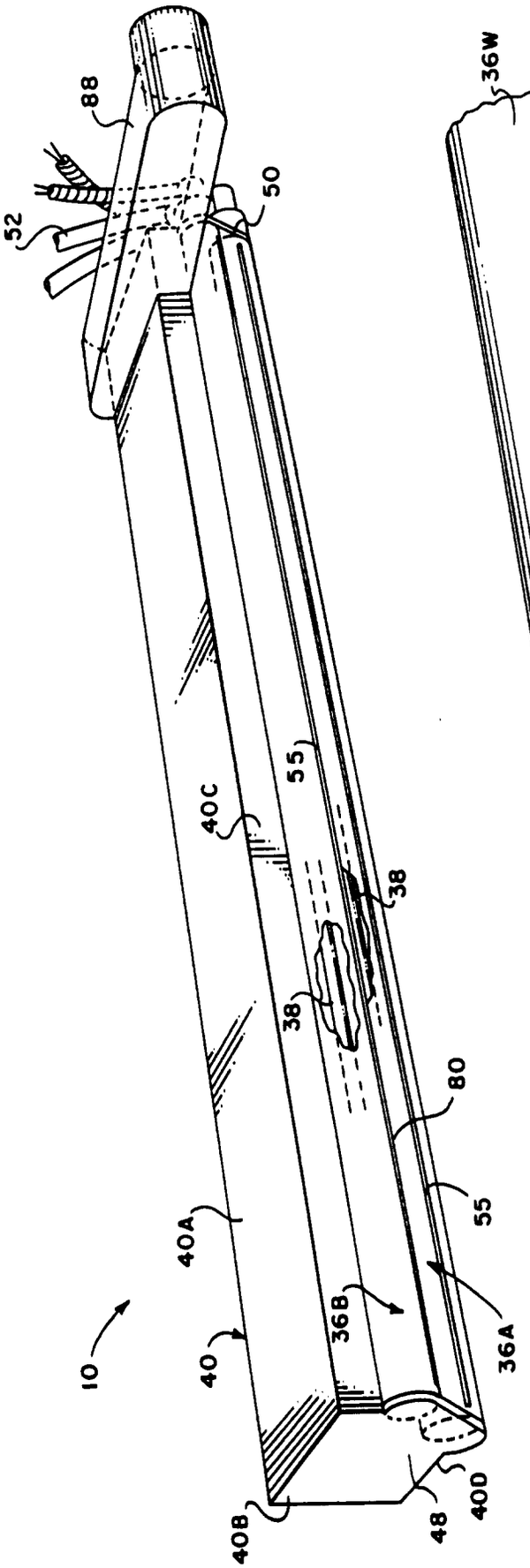

FIG. 10

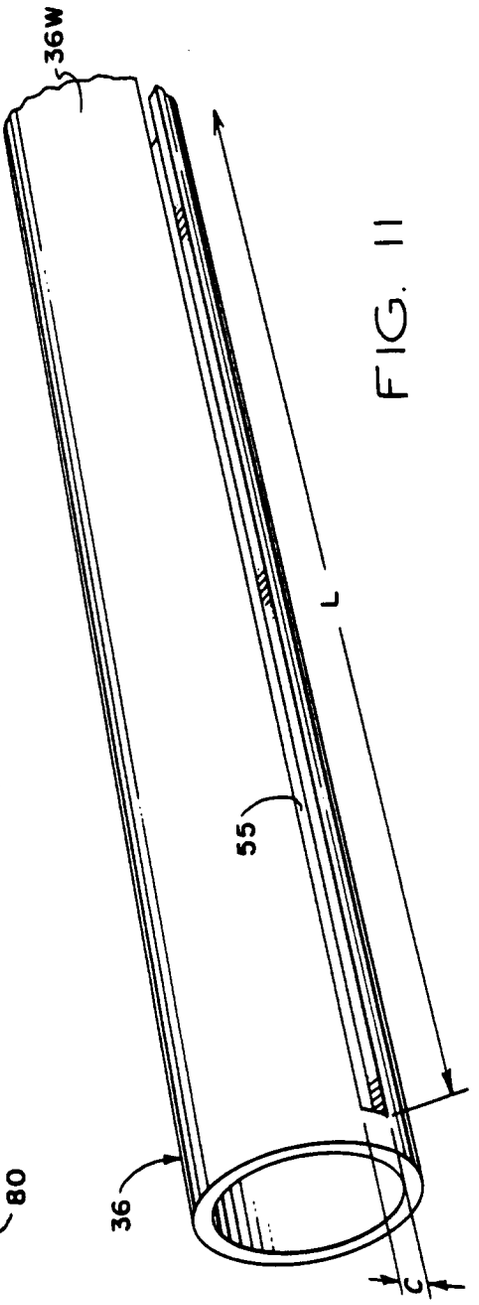

FIG. 11